



SEQUENCE LISTING

<110> Tuomanen, Elaine I
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Koenig, Scott

<120> POLYPEPTIDE COMPRISING THE AMINO ACID OF AN N-TERMINAL
CHOLINE BINDING PROTEIN A TRUNCATE, VACCINE DERIVED
THEREFROM AND USES THEREOF

<130> 5853-2 (207989)

<140> 09/056,019

<141> 1998-04-07

<160> 42

<170> PatentIn Ver. 2.0

<210> 1

<211> 406

<212> PRT

<213> Streptococcus pneumoniae

<400> 1

Glu Asn Glu Gly Ala Thr Gln Val Pro Thr Ser Ser Asn Arg Ala Asn
1 5 10 15

Glu Ser Gln Ala Glu Gln Gly Glu Gln Pro Lys Lys Leu Asp Ser Glu
20 25 30

Arg Asp Lys Ala Arg Lys Glu Val Glu Glu Tyr Val Lys Lys Ile Val
35 40 45

Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val
50 55 60

Ala Leu Val Asn Glu Leu Asn Asn Ile Lys Asn Glu Tyr Leu Asn Lys
65 70 75 80

Ile Val Glu Ser Thr Ser Glu Ser Gln Leu Gln Ile Leu Met Met Glu
85 90 95

Ser Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser
100 105 110

Ser Ser Ser Ser Ser Ser Asp Ser Ser Thr Lys Pro Glu Ala Ser Asp
115 120 125

Thr Ala Lys Pro Asn Lys Pro Thr Glu Pro Gly Glu Lys Val Ala Glu
130 135 140

Ala Lys Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys
145 150 155 160

Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu
 165 170 175
 Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu
 180 185 190
 Leu Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys
 195 200 205
 Gln Ala Glu Ala Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu
 210 215 220
 Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala Glu Glu Glu Ala Lys Arg
 225 230 235 240
 Arg Ala Asp Ala Lys Glu Gln Gly Lys Pro Lys Gly Arg Ala Lys Arg
 245 250 255
 Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala
 260 265 270
 Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser
 275 280 285
 Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu
 290 295 300
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 305 310 315 320
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp
 325 330 335
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys
 340 345 350
 Glu Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu
 355 360 365
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg
 370 375 380
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 385 390 395 400
 Val Lys Glu Lys Pro Ala
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<210> 2

<211> 655

<212> PRT

<213> Streptococcus pneumoniae

<400> 2

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Glu Ser Gln Ala Glu Gln Gly Glu Gln Pro Lys Lys Leu Asp Ser Glu
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 Arg Asp Lys Ala Arg Lys Glu Val Glu Glu Tyr Val Lys Lys Ile Val
 35 40 45
 Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val
 50 55 60
 Ala Leu Val Asn Glu Leu Asn Asn Ile Lys Asn Glu Tyr Leu Asn Lys
 65 70 75 80
 Ile Val Glu Ser Thr Ser Glu Ser Gln Leu Gln Ile Leu Met Met Glu
 85 90 95
 Ser Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser
 100 105 110
 Ser Ser Ser Ser Ser Ser Asp Ser Ser Thr Lys Pro Glu Ala Ser Asp
 115 120 125
 Thr Ala Lys Pro Asn Lys Pro Thr Glu Pro Gly Glu Lys Val Ala Glu
 130 135 140
 Ala Lys Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys
 145 150 155 160
 Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu
 165 170 175
 Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu
 180 185 190
 Leu Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys
 195 200 205
 Gln Ala Glu Ala Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu
 210 215 220
 Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala Glu Glu Glu Ala Lys Arg
 225 230 235 240
 Arg Ala Asp Ala Lys Glu Gln Gly Lys Pro Lys Gly Arg Ala Lys Arg
 245 250 255
 Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala
 260 265 270
 Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser
 275 280 285
 Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu
 290 295 300
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 305 310 315 320

Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp
 325 330 335
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys
 340 345 350
 Glu Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu
 355 360 365
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg
 370 375 380
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys
 385 390 395 400
 Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Lys
 405 410 415
 Ala Glu Lys Pro Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln
 420 425 430
 Pro Lys Ala Glu Lys Pro Ala Asp Gln Gln Ala Glu Glu Asp Tyr Ala
 435 440 445
 Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu Thr Gln Gln Gln Pro Pro
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 Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr Pro Lys Thr Gly Trp Lys
 465 470 475 480
 Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn Thr Asp Gly Ser Met Ala
 485 490 495
 Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ser Asn
 500 505 510
 Gly Ala Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr
 515 520 525
 Leu Asn Ala Asn Gly Ser Met Ala Thr Gly Trp Leu Gln Asn Asn Gly
 530 535 540
 Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Ser Met Ala Thr Gly Trp Leu
 545 550 555 560
 Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Ser Met Ala
 565 570 575
 Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn
 580 585 590
 Gly Asp Met Ala Thr Gly Trp Val Lys Asp Gly Asp Thr Trp Tyr Tyr
 595 600 605
 Leu Glu Ala Ser Gly Ala Met Lys Ala Ser Gln Trp Phe Lys Val Ser
 610 615 620

Asp Lys Trp Tyr Tyr Val Asn Gly Ser Gly Ala Leu Ala Val Asn Thr
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Thr Val Asp Gly Tyr Gly Val Asn Ala Asn Gly Glu Trp Val Asn
 645 650 655

<210> 3

<211> 284

<212> PRT

<213> Streptococcus pneumoniae

<400> 3

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Glu Ser Gln Ala Glu Gln Gly Glu Gln Pro Lys Lys Leu Asp Ser Glu
 20 25 30

Arg Asp Lys Ala Arg Lys Glu Val Glu Glu Tyr Val Lys Lys Ile Val
 35 40 45

Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val
 50 55 60

Ala Leu Val Asn Glu Leu Asn Asn Ile Lys Asn Glu Tyr Leu Asn Lys
 65 70 75 80

Ile Val Glu Ser Thr Ser Glu Ser Gln Leu Gln Ile Leu Met Met Glu
 85 90 95

Ser Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser
 100 105 110

Ser Ser Ser Ser Ser Ser Asp Ser Ser Thr Lys Pro Glu Ala Ser Asp
 115 120 125

Thr Ala Lys Pro Asn Lys Pro Thr Glu Pro Gly Glu Lys Val Ala Glu
 130 135 140

Ala Lys Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys
 145 150 155 160

Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu
 165 170 175

Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu
 180 185 190

Leu Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys
 195 200 205

Gln Ala Glu Ala Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu
 210 215 220

Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala Glu Glu Glu Ala Lys Arg

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 225 | | 230 | | 235 | | 240 | | | | | | | | | |
| Arg | Ala | Asp | Ala | Lys | Glu | Gln | Gly | Lys | Pro | Lys | Gly | Arg | Ala | Lys | Arg |
| | | | | 245 | | | | | 250 | | | | | 255 | |
| Gly | Val | Pro | Gly | Glu | Leu | Ala | Thr | Pro | Asp | Lys | Lys | Glu | Asn | Asp | Ala |
| | | | 260 | | | | | 265 | | | | | 270 | | |
| Lys | Ser | Ser | Asp | Ser | Ser | Val | Gly | Glu | Glu | Thr | Leu | | | | |
| | | 275 | | | | | 280 | | | | | | | | |

<210> 4
 <211> 106
 <212> PRT
 <213> Streptococcus pneumoniae

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|---|
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| 1 5 10 15 |
| Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro |
| 20 25 30 |
| Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val |
| 35 40 45 |
| Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu |
| 50 55 60 |
| Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu Ser |
| 65 70 75 80 |
| Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys |
| 85 90 95 |
| Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala |
| 100 105 |

<210> 5
 <211> 109
 <212> PRT
 <213> Streptococcus pneumoniae

| |
|---|
| <400> 5 |
| Thr Glu Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu |
| 1 5 10 15 |
| Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr |
| 20 25 30 |
| Pro Thr Ile Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp |
| 35 40 45 |
| Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Val Lys Ala Asn |
| 50 55 60 |

Glu Pro Arg Asp Glu Gln Lys Ile Lys Gln Ala Glu Ala Glu Val Glu
65 70 75 80

Ser Lys Gln Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg
85 90 95

Glu Glu Ala Glu Glu Glu Ala Lys Arg Arg Ala Asp Ala
100 105

<210> 6
<211> 4
<212> PRT
<213> Streptococcus pneumoniae

<220>
<221> NON_CONS
<222> (2)..(3)
<223> They could be any amino acid at these two locations.

<400> 6
Lys Xaa Xaa Glu
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<210> 7
<211> 376
<212> PRT
<213> Streptococcus pneumoniae

<400> 7
Glu Asn Glu Gly Ser Thr Gln Ala Ala Thr Ser Ser Asn Met Ala Lys
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Thr Glu His Arg Lys Ala Ala Lys Gln Val Val Asp Glu Tyr Ile Glu
20 25 30

Lys Met Leu Arg Glu Ile Gln Leu Asp Arg Arg Lys His Thr Gln Asn
35 40 45

Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg
50 55 60

Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu
65 70 75 80

Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr
85 90 95

Leu Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu
100 105 110

Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
115 120 125

Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp
 130 135 140
 Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys
 145 150 155 160
 Glu Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu
 165 170 175
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg
 180 185 190
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys
 195 200 205
 Glu Ala Asn Val Ala Thr Ser Asp Gln Gly Lys Pro Lys Gly Arg Ala
 210 215 220
 Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn
 225 230 235 240
 Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser
 245 250 255
 Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val
 260 265 270
 Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg
 275 280 285
 Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu
 290 295 300
 Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu
 305 310 315 320
 Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys
 325 330 335
 Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr
 340 345 350
 Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu
 355 360 365
 Asp Lys Val Lys Glu Lys Pro Ala
 370 375

<210> 8

<211> 663

<212> PRT

<213> Streptococcus pneumoniae

<400> 8

Glu Asn Glu Gly Ser Thr Gln Ala Ala Thr Ser Ser Asn Met Ala Lys
 1 5 10 15

Thr Glu His Arg Lys Ala Ala Lys Gln Val Val Asp Glu Tyr Ile Glu
 20 25 30
 Lys Met Leu Arg Glu Ile Gln Leu Asp Arg Arg Lys His Thr Gln Asn
 35 40 45
 Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg
 50 55 60
 Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu
 65 70 75 80
 Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr
 85 90 95
 Leu Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu
 100 105 110
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 115 120 125
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp
 130 135 140
 Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys
 145 150 155 160
 Glu Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu
 165 170 175
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg
 180 185 190
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys
 195 200 205
 Glu Ala Asn Val Ala Thr Ser Asp Gln Gly Lys Pro Lys Gly Arg Ala
 210 215 220
 Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn
 225 230 235 240
 Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser
 245 250 255
 Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val
 260 265 270
 Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg
 275 280 285
 Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu
 290 295 300
 Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu
 305 310 315 320

Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys
 325 330 335
 Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr
 340 345 350
 Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu
 355 360 365
 Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala
 370 375 380
 Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys Pro Ala Glu Gln
 385 390 395 400
 Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu Glu Asp Tyr Ala
 405 410 415
 Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu Thr Gln Gln Gln Pro Pro
 420 425 430
 Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr Pro Lys Thr Gly Trp Lys
 435 440 445
 Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn Thr Asp Gly Ser Met Ala
 450 455 460
 Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn
 465 470 475 480
 Gly Ala Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr
 485 490 495
 Leu Asn Ala Asn Gly Ser Met Ala Thr Gly Trp Leu Gln Asn Asn Gly
 500 505 510
 Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Ala Met Ala Thr Gly Trp Leu
 515 520 525
 Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ser Asn Gly Ala Met Ala
 530 535 540
 Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn
 545 550 555 560
 Gly Asp Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr
 565 570 575
 Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Leu Gln Tyr Asn Gly
 580 585 590
 Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Val
 595 600 605
 Lys Asp Gly Asp Thr Trp Tyr Tyr Leu Glu Ala Ser Gly Ala Met Lys
 610 615 620

Ala Ser Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly
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Ser Gly Ala Leu Ala Val Asn Thr Thr Val Asp Gly Tyr Gly Val Asn
645 650 655

Ala Asn Gly Glu Trp Val Asn
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<210> 9

<211> 254

<212> PRT

<213> Streptococcus pneumoniae

<400> 9

Glu Asn Glu Gly Ser Thr Gln Ala Ala Thr Ser Ser Asn Met Ala Lys
1 5 10 15

Thr Glu His Arg Lys Ala Ala Lys Gln Val Val Asp Glu Tyr Ile Glu
20 25 30

Lys Met Leu Arg Glu Ile Gln Leu Asp Arg Arg Lys His Thr Gln Asn
35 40 45

Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg
50 55 60

Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu
65 70 75 80

Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr
85 90 95

Leu Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu
100 105 110

Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
115 120 125

Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp
130 135 140

Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys
145 150 155 160

Glu Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu
165 170 175

Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg
180 185 190

Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys
195 200 205

Glu Ala Asn Val Ala Thr Ser Asp Gln Gly Lys Pro Lys Gly Arg Ala

| | | |
|---|-----|---------|
| 210 | 215 | 220 |
| Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn | | |
| 225 | 230 | 235 240 |

| |
|---|
| Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu |
| 245 250 |

<210> 10
 <211> 106
 <212> PRT
 <213> Streptococcus pneumoniae

| |
|---|
| <400> 10 |
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| 1 5 10 15 |

| |
|---|
| Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro |
| 20 25 30 |

| |
|---|
| Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu Ser Asp Val |
| 35 40 45 |

| |
|---|
| Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu |
| 50 55 60 |

| |
|---|
| Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys Val Glu Ser |
| 65 70 75 80 |

| |
|---|
| Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg Lys |
| 85 90 95 |

| |
|---|
| Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala |
| 100 105 |

<210> 11
 <211> 107
 <212> PRT
 <213> Streptococcus pneumoniae

| |
|---|
| <400> 11 |
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| |
|---|
| Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro Thr |
| 20 25 30 |

| |
|---|
| Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp Val Lys |
| 35 40 45 |

| |
|---|
| Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu Ser |
| 50 55 60 |

| |
|---|
| Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu Ser Lys |
| 65 70 75 80 |

Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg Lys Lys
85 90 95

Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala
100 105

<210> 12
<211> 1219
<212> DNA
<213> Streptococcus pneumoniae

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gaggaatatg taataaaaaat agtgggtgag agctatgcaa aatcaactaa aaagcgacat 180
acaattactg tagctctagt taacgagttg aacaacatta agaacgagta tttgaataaaa 240
atagttgaat caacctcaga aagccaacta cagatactga tgatggagag tcgatcaaaa 300
gtagatgaag ctgtgtctaa gtttgaaaag gactcatctt cttcgtcaag ttcagactct 360
tccactaaac cggaagcttc agatacagcg aagccaaaca agccgacaga accaggagaa 420
aaggtagcag aagctaagaa gaagggtgaa gaagctgaga aaaaagccaa ggatcaaaaa 480
gaagaagatc gtcgtaacta cccaaccatt acttacaata cgcttgaact tgaaattgct 540
gagtcggatg tggaaagttaa aaaagcggag cttgaactag taaaagtga agctaacgaa 600
cctcgagacg agcaaaaaat taagcaagca gaagcgggaag ttgagagtaa acaagctgag 660
gctacaagggt taataaaaaat caagacagat cgtgaagaag cagaagaaga agctaaacga 720
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gttaaagaaa aaccagctg 1219

<210> 13
<211> 1969
<212> DNA
<213> Streptococcus pneumoniae

<400> 13
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gaacaaggag aacaacctaa aaaactcgat tcagaacgag ataaggcaag gaaagagggtc 120
gaggaatatg taataaaaaat agtgggtgag agctatgcaa aatcaactaa aaagcgacat 180
acaattactg tagctctagt taacgagttg aacaacatta agaacgagta tttgaataaaa 240
atagttgaat caacctcaga aagccaacta cagatactga tgatggagag tcgatcaaaa 300
gtagatgaag ctgtgtctaa gtttgaaaag gactcatctt cttcgtcaag ttcagactct 360
tccactaaac cggaagcttc agatacagcg aagccaaaca agccgacaga accaggagaa 420
aaggtagcag aagctaagaa gaagggtgaa gaagctgaga aaaaagccaa ggatcaaaaa 480
gaagaagatc gtcgtaacta cccaaccatt acttacaata cgcttgaact tgaaattgct 540
gagtcggatg tggaaagttaa aaaagcggag cttgaactag taaaagtga agctaacgaa 600
cctcgagacg agcaaaaaat taagcaagca gaagcgggaag ttgagagtaa acaagctgag 660
gctacaagggt taataaaaaat caagacagat cgtgaagaag cagaagaaga agctaaacga 720
agagcagatg ctaaagagca aggtaaacca aaggggcggg caaacgagg agttcctgga 780
gagctagcaa cacctgataa aaaagaaaat gatgcgaagt cttcagattc tagcgtaggt 840
gaagaaactc ttccaagccc atccctgaaa ccagaaaaaa aggtagcaga agctgagaag 900

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aaggttgaag aagctaagaa aaaagccgag gatcaaaaag aagaagatcg ccgtaactac 960
ccaaccaata cttacaaaac gcttgaactt gaaattgctg agtccgatgt ggaagttaaa 1020
aaagcggagg cttgaactag taaaagagga agctaaggaa cctcgaaacg aggaaaaagt 1080
taagcaagca aaagcgggaag ttgagagtaa aaaagctgag gctacaaggt tagaaaaaat 1140
caagacagat cgtaaaaaag cagaagaaga agctaaacga aaagcagcag aagaagataa 1200
agttaaagaa aaaccagctg aacaaccaca accagcgccg gctccaaaag cagaaaaacc 1260
agctccagct ccaaaaaccag agaatccagc tgaacaacca aaagcagaaa aaccagctga 1320
tcaacaagct gaagaagact atgctcgtag atcagaagaa gaataataatc gcttgactca 1380
acagcaaccg ccaaaaactg aaaaaccagc acaaccatct actccaaaaa caggctggaa 1440
acaagaaaac ggtatgtggt acttctacaa tactgatggt tcaatggcga caggatggct 1500
ccaaaacaat ggctcatggt actacctcaa cagcaatggc gctatggcga caggatggct 1560
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gaaagatgga gatacctggt actatcttga agcatcaggt gctatgaaag caagccaatg 1860
gttcaaagta tcagataaat ggtactatgt caatggctca ggtgcccttg cagtcaacac 1920
aactgtagat ggctatggag tcaatgccaa tggatgaatgg gtaaaactaa 1969

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<210> 14

<211> 853

<212> DNA

<213> Streptococcus pneumoniae

<400> 14

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gaggaatatg taaaaaaaat agtgggtgag agctatgcaa aatcaactaa aaagcgacat 180
acaattactg tagctctagt taacgagttg aacaacatta agaacgagta tttgaataaa 240
atagttgaat caacctcaga aagccaacta cagatactga tgatggagag tcgatcaaaa 300
gtagatgaag ctgtgtctaa gtttgaaaag gactcatctt ctctgtcaag ttcagactct 360
tccactaaac cggaagcttc agatacagcg aagccaacaa agccgacaga accaggagaa 420
aaggtagcag aagctaagaa gaagggtgaa gaagctgaga aaaaagccaa ggatcaaaaa 480
gaagaagatc gtcgtaacta cccaaccatt acttacaata cgcttgaact tgaaattgct 540
gagtccgatg tggaaagttaa aaaagcggag cttgaactag taaaagttaa agctaacgaa 600
cctcgagacg agcaaaaaat taagcaagca gaagcgggaag ttgagagtaa acaagctgag 660
gctacaaggt taaaaaaaat caagacagat cgtgaagaag cagaagaaga agctaaacga 720
agagcagatg ctaaagagca aggtaaacca aaggggcggg caaaacgagg agttcctgga 780
gagctagcaa cacctgataa aaaagaaaat gatgcgaagt cttcagattc tagcgtaggt 840
gaagaaactc ttc 853

```

<210> 15

<211> 318

<212> DNA

<213> Streptococcus pneumoniae

<400> 15

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aaaccagaaa aaaaggtagc agaagctgag aagaagggtt aagaagctaa gaaaaaagcc 60
gaggatcaaa aagaagaaga tcgccgtaac tacccaacca atacttacia aacgcttgaa 120
cttgaaattg ctgagtcgga tgtggaagtt aaaaaagcgg agcttgaact agtaaaagag 180
gaagctaagg aacctcgaaa cgaggaaaaa gttaagcaag caaaagcggg agttgagagt 240
aaaaaagctg aggtacaaag gttagaaaaa atcaagacag atcgtaaaaa agcagaagaa 300
gaagctaaac gaaaagca 318

```

<210> 16

<211> 327

<212> DNA

<213> Streptococcus pneumoniae

<400> 16

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acagaaccag gagaaaaggt agcagaagct aagaagaagg ttgaagaagc tgagaaaaaa 60
gccaaggatc aaaaagaaga agatcgtcgt aactacccaa ccattactta caaaacgctt 120
gaacttgaaa ttgctgagtc cgatgtggaa gttaaaaaaag cggagcttga actagtaaaa 180
gtgaaagcta acgaacctcg agacgagcaa aaaattaagc aagcagaagc ggaagttgag 240
agtaaacaag ctgagggtac aagggttaaaa aaaatcaaga cagatcgtga agaagcagaa 300
gaagaagcta aacgaagagc agatgct                                     327
```

<210> 17

<211> 1129

<212> DNA

<213> Streptococcus pneumoniae

<400> 17

```
gaaaacgaag gaagtaccca agcagccact tcttctaata tggcaaagac agaacatagg 60
aaagctgcta aacaagtcgt cgatgaatat atagaaaaaa tggtgaggga gattcaacta 120
gatagaagaa aacataccca aaatgtcgcc ttaaacataa agttgagcgc aattaaaaacg 180
aagtatttgc gtgaattaaa tgtttttagaa gagaagtcga aagatgagtt gccgtcagaa 240
ataaaagcaa agttagacgc agcttttgag aagtttaaaa aagatacatt gaaaccagga 300
gaaaaggtag cagaagctaa gaagaagggt gaagaagcta agaaaaaagc cgaggatcaa 360
aaagaagaag atcgtcgtaa ctaccaacc aatacttaca aaacgcttga acttgaaatt 420
gctgagttcg atgtgaaagt taaagaagcg gagcttgaac tagtaaaaga ggaagctaaa 480
gaatctcgaa acgagggcac aattaagcaa gcaaaagaga aagttgagag taaaaaagct 540
gaggctacaa ggtagaaaa catcaagaca gatcgtaaaa aagcagaaga agaagctaaa 600
cgaaaagcag atgctaagtt gaaggaagct aatgtagcga cttcagatca aggtaaacca 660
aaggggcggg caaaacgagg agttcctgga gagctagcaa cacctgataa aaaagaaaaat 720
gatgcgaagt cttcagattc tagcgtaggt gaagaaactc ttccaagctc atccctgaaa 780
tcaggaaaaa aggtagcaga agctgagaag aagggtgaag aagctgagaa aaaagccaag 840
gatcaaaaag aagaagatcg ccgtaactac ccaaccaata cttacaaaac gcttgacctt 900
gaaattgctg agtccgatgt gaaagttaaa gaagcggagc ttgaactagt aaaagaggaa 960
gctaagggaac ctcgagacga ggaaaaaatt aagcaagcaa aagcgaaagt tgagagtaaa 1020
aaagctgagg ctacaagggt agaaaaacatc aagcacagatc gtaaaaaaagc agaagaagaa 1080
gctaaacgaa aagcagcaga agaagataaa gttaaagaaa aaccagctg                                     1129
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<210> 18

<211> 1992

<212> DNA

<213> Streptococcus pneumoniae

<400> 18

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gaaaacgaag gaagtaccca agcagccact tcttctaata tggcaaagac agaacatagg 60
aaagctgcta aacaagtcgt cgatgaatat atagaaaaaa tggtgaggga gattcaacta 120
gatagaagaa aacataccca aaatgtcgcc ttaaacataa agttgagcgc aattaaaaacg 180
aagtatttgc gtgaattaaa tgtttttagaa gagaagtcga aagatgagtt gccgtcagaa 240
ataaaagcaa agttagacgc agcttttgag aagtttaaaa aagatacatt gaaaccagga 300
gaaaaggtag cagaagctaa gaagaagggt gaagaagcta agaaaaaagc cgaggatcaa 360
aaagaagaag atcgtcgtaa ctaccaacc aatacttaca aaacgcttga acttgaaatt 420
gctgagttcg atgtgaaagt taaagaagcg gagcttgaac tagtaaaaga ggaagctaaa 480
gaatctcgaa acgagggcac aattaagcaa gcaaaagaga aagttgagag taaaaaagct 540
gaggctacaa ggtagaaaa catcaagaca gatcgtaaaa aagcagaaga agaagctaaa 600
cgaaaagcag atgctaagtt gaaggaagct aatgtagcga cttcagatca aggtaaacca 660
aaggggcggg caaaacgagg agttcctgga gagctagcaa cacctgataa aaaagaaaaat 720
gatgcgaagt cttcagattc tagcgtaggt gaagaaactc ttccaagctc atccctgaaa 780
tcaggaaaaa aggtagcaga agctgagaag aagggtgaag aagctgagaa aaaagccaag 840
gatcaaaaag aagaagatcg ccgtaactac ccaaccaata cttacaaaac gcttgacctt 900
```

```

gaaattgctg agtccgatgt gaaagttaaa gaagcggagc ttgaactagt aaaagaggaa 960
gctaaggaac ctcgagacga ggaaaaaatt aagcaagcaa aagcgaaagt tgagagtaaa 1020
aaagctgagg ctacaagggt agaaaaacatc aagacagatc gtaaaaaagc agaagaagaa 1080
gctaaacgaa aagcagcgaga agaagataaa gttaaagaaa aaccagctga acaaccacaa 1140
ccagcgccgg ctactcaacc agaaaaacca gctccaaaac cagagaagcc agctgaacaa 1200
ccaaaagcag aaaaaacaga tgatcaacaa gctgaagaag actatgctcg tagatcagaa 1260
gaagaatata atcgcttgac tcaacagcaa ccgcaaaaaa ctgaaaaacc agcacaacca 1320
tctactccaa aaacagggtg gaaacaagaa aacgggtatgt ggtacttcta caatactgat 1380
ggttcaatgg caacaggatg gctccaaaac aacgggttcat ggtactatct aaacgctaata 1440
ggtgctatgg cgacaggatg gctccaaaac aatgggttcat ggtactatct aaacgctaata 1500
ggttcaatgg caacaggatg gctccaaaac aatgggttcat ggtactacct aaacgctaata 1560
ggtgctatgg cgacaggatg gctccaaatac aatgggttcat ggtactacct aaacagcaata 1620
ggcgctatgg cgacaggatg gctccaaatac aatgggttcat ggtactacct caacgctaata 1680
ggtgatatgg cgacaggatg gctccaaaac aacgggttcat ggtactacct caacgctaata 1740
ggtgatatgg cgacaggatg gctccaaatac aacgggttcat ggtattacct caacgctaata 1800
ggtgatatgg cgacagggtt ggtgaaagat ggagatacct ggtactatct tgaagcatca 1860
ggtgctatga aagcaagcca atgggttcaaa gtatcagata aatgggtacta tgtcaatggc 1920
tcaggtgccc ttgcagtcaa cacaactgta gatgggctatg gagtcaatgc caatggtgaa 1980
tgggtaaact aa
1992

```

<210> 19

<211> 763

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 19

```

gaaaacgaag gaagtaccca agcagccact tcttctaata tggcaaagac agaacatagg 60
aaagctgcta aacaagtcgt cgatgaatat atagaaaaaa tgttgaggga gattcaacta 120
gatagaagaa aacataccca aaatgtcgcc ttaaacataa agttgagcgc aattaaaacg 180
aagtattttgc gtgaattaaa tgttttagaa gagaagtcga aagatgagtt gccgtcagaa 240
ataaaaagcaa agttagacgc agctttttgag aagtttaaaa aagatacatt gaaaccagga 300
gaaaaggtag cagaagctaa gaagaagggt gaagaagcta agaaaaaagc cgaggatcaa 360
aaagaagaag atcgtcgtaa ctaccaaac ctactttaca aaacgcttga acttgaaatt 420
gctgagttcg atgtgaaagt taaagaagcg gagcttgaac tagtaaaaga ggaagctaaa 480
gaatctcgaa acgagggcac aattaagcaa gcaaaaagaga aagttgagag taaaaaagct 540
gaggctacaa ggtagaaaa catcaagaca gatcgtaaaa aagcagaaga agaagctaaa 600
cgaaaagcag atgctaagtt gaaggaagct aatgtagcga cttcagatca aggtaaaacca 660
aaggggaggg caaaacgagg agttcctgga gagctagcaa cacctgataa aaaagaaaat 720
gatgcgaagt cttcagattc tagcgtaggt gaagaaactc ttc
763

```

<210> 20

<211> 318

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 20

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aaatcaggaa aaaaggtagc agaagctgag aagaagggtg aagaagctga gaaaaaagcc 60
aaggatcaaa aagaagaaga tcgccgtaac taccacaacca atacttaca aacgcttgac 120
cttgaaattg ctgagtcgga tgtgaaagtt aaagaagcgg agcttgaaact agtaaaagag 180
gaagctaagg aacctcgaga cgaggaaaaa attaagcaag caaaagcgaa agttgagagt 240
aaaaaagctg aggtacaag gttagaaaac atcaagacag atcgtaaaaa agcagaagaa 300
gaagctaaac gaaaagca
318

```

<210> 21

<211> 321

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 21
ccaggagaaa aggttagcaga agctaagaag aaggttgaag aagctaagaa aaaagccgag 60
gatcaaaaag aagaagatcg tcgtaactac ccaaccaata cttacaaaac gcttgaactt 120
gaaattgctg agttcgatgt gaaagttaaa gaagcggagc ttgaactagt aaaagaggaa 180
gctaaagaat ctcgaaacga gggcacaatt aagcaagcaa aagagaaaagt tgagagtaaa 240
aaagctgagg ctacaagggtt agaaaaacatc aagacagatc gtaaaaaaagc agaagaagaa 300
gctaaacgaa aagcagatgc t 321

<210> 22
<211> 121
<212> PRT
<213> Streptococcus pneumoniae

<400> 22
Ser Pro Ser Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys
1 5 10 15
Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg
20 25 30
Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala
35 40 45
Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu
50 55 60
Glu Ala Lys Glu Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala
65 70 75 80
Glu Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys
85 90 95
Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu
100 105 110
Glu Asp Lys Val Lys Glu Lys Pro Ala
115 120

<210> 23
<211> 122
<212> PRT
<213> Streptococcus pneumoniae

<400> 23
Pro Ser Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Glu Lys
1 5 10 15
Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp
20 25 30
Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile
35 40 45
Ala Glu Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys
50 55 60

Glu Glu Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys
 65 70 75 80
 Ala Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile
 85 90 95
 Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala
 100 105 110
 Glu Glu Asp Lys Val Lys Glu Lys Arg Ala
 115 120

<210> 24
 <211> 428
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 24
 Glu Asn Glu Gly Ala Thr Gln Val Pro Thr Ser Ser Asn Arg Ala Asn
 1 5 10 15
 Glu Ser Gln Ala Glu Gln Gly Glu Gln Pro Lys Lys Leu Asp Ser Glu
 20 25 30
 Arg Asp Lys Ala Arg Lys Glu Val Glu Glu Tyr Val Lys Lys Ile Val
 35 40 45
 Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val
 50 55 60
 Ala Leu Val Asn Glu Leu Asn Asn Ile Lys Asn Glu Tyr Leu Asn Lys
 65 70 75 80
 Ile Val Glu Ser Thr Ser Glu Ser Gln Leu Gln Ile Leu Met Met Glu
 85 90 95
 Ser Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser
 100 105 110
 Ser Ser Ser Ser Ser Ser Asp Ser Ser Thr Lys Pro Glu Ala Ser Asp
 115 120 125
 Thr Ala Lys Pro Asn Lys Pro Thr Glu Pro Gly Glu Lys Val Ala Glu
 130 135 140
 Ala Lys Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys
 145 150 155 160
 Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu
 165 170 175
 Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu
 180 185 190
 Leu Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys

| 195 | 200 | 205 |
|-------------------------|-------------------------|-----------------------------|
| Gln Ala Glu Ala Glu Val | Glu Ser Lys Gln Ala | Glu Ala Thr Arg Leu |
| 210 | 215 | 220 |
| Lys Lys Ile Lys Thr | Asp Arg Glu Glu Ala | Glu Glu Glu Ala Lys Arg |
| 225 | 230 | 235 240 |
| Arg Ala Asp Ala | Lys Glu Gln Gly Lys | Pro Lys Gly Arg Ala Lys Arg |
| 245 | 250 | 255 |
| Gly Val Pro Gly Glu Leu | Ala Thr Pro Asp Lys Lys | Glu Asn Asp Ala |
| 260 | 265 | 270 |
| Lys Ser Ser Asp Ser Ser | Val Gly Glu Glu Thr | Leu Pro Ser Pro Ser |
| 275 | 280 | 285 |
| Leu Lys Pro Glu Lys Lys | Val Ala Glu Ala Glu | Lys Lys Val Glu Glu |
| 290 | 295 | 300 |
| Ala Lys Lys Lys Ala | Glu Asp Gln Lys Glu | Glu Asp Arg Arg Asn Tyr |
| 305 | 310 | 315 320 |
| Pro Thr Asn Thr Tyr | Lys Thr Leu Glu Leu | Glu Ile Ala Glu Ser Asp |
| 325 | 330 | 335 |
| Val Glu Val Lys Lys | Ala Glu Leu Glu Leu | Val Lys Glu Glu Ala Lys |
| 340 | 345 | 350 |
| Glu Pro Arg Asn Glu Glu | Lys Val Lys Gln Ala | Lys Ala Glu Val Glu |
| 355 | 360 | 365 |
| Ser Lys Lys Ala Glu Ala | Thr Arg Leu Glu Lys | Ile Lys Thr Asp Arg |
| 370 | 375 | 380 |
| Lys Lys Ala Glu Glu Glu | Ala Lys Arg Lys Ala | Ala Glu Glu Asp Lys |
| 385 | 390 | 395 400 |
| Val Lys Glu Lys Pro Ala | Glu Gln Pro Gln Pro | Ala Pro Ala Pro Lys |
| 405 | 410 | 415 |
| Ala Glu Lys Pro Ala Pro | Ala Pro Lys Pro | Glu Asn |
| 420 | 425 | |

<210> 25
 <211> 23
 <212> DNA
 <213> Streptococcus pneumoniae

<400> 25
 ggcggatcca tggaraayga rgg

23

<210> 26
 <211> 33
 <212> DNA
 <213> Streptococcus pneumoniae

<400> 26
gccgtcgact tagtttaccc attcaccatt ggc

33

<210> 27
<211> 5
<212> PRT
<213> Streptococcus pneumoniae

<220>
<221> VARIANT
<222> (1)
<223> It could be any amino acid.

<400> 27
Xaa Glu Asn Glu Gly
1 5

<210> 28
<211> 439
<212> PRT
<213> Streptococcus pneumoniae

<220>
<221> VARIANT
<222> (243)
<223> It could be any amino acid.

<400> 28
Ala Val Ala Ser Leu Phe Met Gly Ser Val Val His Ala Thr Glu Lys
1 5 10 15
Glu Val Thr Thr Gln Val Ala Thr Ser Ser Asn Lys Ala Asn Lys Ser
20 25 30
Gln Thr Glu His Met Lys Ala Ala Lys Gln Val Asp Glu Tyr Ile Lys
35 40 45
Lys Lys Leu Gln Leu Asp Arg Arg Lys His Thr Gln Asn Val Gly Leu
50 55 60
Leu Thr Lys Leu Gly Val Ile Lys Thr Glu Tyr Leu His Gly Leu Ser
65 70 75 80
Val Ser Lys Lys Lys Ser Glu Ala Glu Leu Pro Ser Glu Ile Lys Ala
85 90 95
Lys Leu Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu Pro Thr
100 105 110
Glu Pro Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala
115 120 125
Lys Lys Lys Ala Glu Asp Gln Lys Glu Lys Asp Leu Arg Asn Tyr Pro
130 135 140

Thr Asn Thr Tyr Lys Thr Leu Glu Leu Asp Ile Ala Glu Ser Asp Val
 145 150 155 160
 Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu
 165 170 175
 Ser Arg Asp Glu Lys Lys Ile Asn Gln Ala Lys Ala Lys Val Glu Asn
 180 185 190
 Lys Lys Ala Glu Ala Thr Arg Leu Lys Asn Ile Lys Thr Asp Arg Glu
 195 200 205
 Lys Ala Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Leu Gln Glu Ala
 210 215 220
 Asn Val Ala Thr Ser Glu Gln Asp Lys Ser Lys Arg Arg Ala Lys Arg
 225 230 235 240
 Glu Val Xaa Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala
 245 250 255
 Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Thr Ser Pro Ser
 260 265 270
 Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu
 275 280 285
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 290 295 300
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp
 305 310 315 320
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys
 325 330 335
 Glu Ser Arg Asn Glu Glu Lys Ile Lys Gln Val Lys Ala Lys Val Glu
 340 345 350
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg
 355 360 365
 Lys Lys Ala Glu Glu Glu Glu Ala Lys Arg Arg Ala Ala Glu Glu Asp
 370 375 380
 Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro
 385 390 395 400
 Gln Pro Glu Lys Pro Thr Glu Glu Pro Glu Asn Pro Ala Pro Ala Pro
 405 410 415
 Ala Pro Lys Pro Glu Asn Pro Ala Glu Lys Pro Lys Ala Glu Lys Pro
 420 425 430
 Ala Asp Gln Gln Ala Glu Glu
 435

<210> 29
 <211> 437
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 29

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ala | Val | Ala | Ser | Leu | Phe | Met | Gly | Ser | Val | Val | His | Ala | Thr | Glu | Lys |
| 1 | | | | 5 | | | | | 10 | | | | | 15 | |
| Glu | Val | Thr | Thr | Gln | Val | Ala | Thr | Ser | Ser | Asn | Arg | Ala | Asn | Lys | Ser |
| | | | 20 | | | | | 25 | | | | | 30 | | |
| Gln | Thr | Glu | His | Met | Lys | Ala | Ala | Lys | Gln | Val | Asp | Glu | Tyr | Ile | Lys |
| | | 35 | | | | | 40 | | | | | 45 | | | |
| Lys | Lys | Leu | Gln | Leu | Asp | Arg | Arg | Lys | His | Thr | Gln | Asn | Val | Gly | Leu |
| | 50 | | | | | 55 | | | | | 60 | | | | |
| Leu | Thr | Lys | Leu | Gly | Val | Ile | Lys | Thr | Glu | Tyr | Leu | His | Gly | Leu | Ser |
| 65 | | | | | 70 | | | | | 75 | | | | | 80 |
| Val | Ser | Lys | Lys | Lys | Ser | Glu | Ala | Glu | Leu | Pro | Ser | Glu | Ile | Lys | Ala |
| | | | | 85 | | | | | 90 | | | | | 95 | |
| Lys | Leu | Asp | Ala | Ala | Phe | Glu | Gln | Phe | Lys | Lys | Asp | Thr | Leu | Pro | Thr |
| | | | 100 | | | | | 105 | | | | | 110 | | |
| Glu | Pro | Gly | Lys | Lys | Val | Ala | Glu | Ala | Glu | Lys | Lys | Val | Glu | Glu | Ala |
| | | 115 | | | | | 120 | | | | | 125 | | | |
| Lys | Lys | Lys | Ala | Glu | Asp | Gln | Lys | Glu | Lys | Asp | Leu | Arg | Asn | Tyr | Pro |
| | 130 | | | | | 135 | | | | | 140 | | | | |
| Thr | Asn | Thr | Tyr | Lys | Thr | Leu | Glu | Leu | Asp | Ile | Ala | Glu | Ser | Asp | Val |
| 145 | | | | | 150 | | | | | 155 | | | | | 160 |
| Glu | Val | Lys | Lys | Ala | Glu | Leu | Glu | Leu | Val | Lys | Glu | Glu | Ala | Lys | Glu |
| | | | | 165 | | | | | 170 | | | | | 175 | |
| Ser | Arg | Asp | Glu | Lys | Lys | Ile | Asn | Gln | Ala | Lys | Ala | Lys | Val | Glu | Asn |
| | | | 180 | | | | | 185 | | | | | 190 | | |
| Lys | Lys | Ala | Glu | Ala | Thr | Arg | Leu | Lys | Asn | Ile | Lys | Thr | Asp | Arg | Glu |
| | | 195 | | | | | 200 | | | | | 205 | | | |
| Lys | Ala | Glu | Glu | Ala | Lys | Arg | Arg | Ala | Asp | Ala | Lys | Leu | Gln | Glu | Ala |
| | 210 | | | | | 215 | | | | | 220 | | | | |
| Asn | Val | Ala | Thr | Ser | Glu | Gln | Asp | Lys | Ser | Lys | Arg | Arg | Ala | Lys | Arg |
| 225 | | | | | 230 | | | | | 235 | | | | | 240 |
| Glu | Val | Leu | Gly | Glu | Leu | Ala | Thr | Pro | Asp | Lys | Lys | Glu | Asn | Asp | Ala |
| | | | | 245 | | | | | 250 | | | | | 255 | |
| Lys | Ser | Ser | Asp | Ser | Ser | Val | Gly | Glu | Glu | Thr | Leu | Thr | Ser | Pro | Ser |
| | | | 260 | | | | | 265 | | | | | 270 | | |

Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu
 275 280 285
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 290 295 300
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp
 305 310 315 320
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys
 325 330 335
 Glu Ser Arg Asn Glu Glu Lys Ile Lys Gln Val Lys Ala Lys Val Glu
 340 345 350
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg
 355 360 365
 Lys Lys Ala Glu Glu Glu Glu Ala Lys Arg Arg Ala Ala Glu Glu Asp
 370 375 380
 Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro
 385 390 395 400
 Gln Pro Glu Lys Pro Thr Glu Glu Pro Glu Asn Pro Ala Pro Ala Pro
 405 410 415
 Ala Pro Lys Pro Glu Asn Pro Ala Glu Lys Pro Lys Ala Glu Lys Pro
 420 425 430
 Ala Asp Gln Gln Ala
 435

<210> 30
 <211> 439
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 30
 Val Ala Val Ala Ser Leu Val Met Gly Ser Val Val His Ala Thr Glu
 1 5 10 15
 Lys Glu Val Thr Thr Gln Val Ala Thr Ser Ser Asn Arg Ala Asn Glu
 20 25 30
 Ser Gln Ala Gly His Arg Lys Ala Ala Glu Gln Phe Asp Glu Tyr Ile
 35 40 45
 Lys Thr Met Ile Gln Leu Asp Arg Arg Lys His Thr Gln Asn Phe Ala
 50 55 60
 Leu Asn Ile Lys Leu Ser Arg Ile Lys Thr Glu Tyr Leu Arg Lys Leu
 65 70 75 80
 Asn Val Leu Glu Glu Lys Ser Lys Ala Glu Leu Pro Ser Glu Thr Lys

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | | | | 85 | | | | 90 | | | | 95 | | | |
| Lys | Glu | Ile | Asp | Ala | Ala | Phe | Glu | Gln | Phe | Lys | Lys | Asp | Thr | Asn | Arg |
| 100 | | | | 105 | | | | 110 | | | | | | | |
| Thr | Lys | Lys | Thr | Val | Ala | Glu | Ala | Glu | Lys | Lys | Val | Glu | Glu | Ala | Lys |
| 115 | | | | 120 | | | | 125 | | | | | | | |
| Lys | Lys | Ala | Lys | Ala | Gln | Lys | Glu | Glu | Asp | His | Arg | Asn | Tyr | Pro | Thr |
| 130 | | | | 135 | | | | 140 | | | | | | | |
| Asn | Thr | Tyr | Lys | Thr | Leu | Glu | Leu | Glu | Ile | Ala | Glu | Ser | Asp | Val | Glu |
| 145 | | | | 150 | | | | 155 | | | | 160 | | | |
| Val | Lys | Lys | Ala | Glu | Leu | Glu | Leu | Val | Lys | Glu | Glu | Ala | Lys | Glu | Ser |
| 165 | | | | 170 | | | | 175 | | | | | | | |
| Arg | Asp | Asp | Glu | Lys | Ile | Lys | Gln | Ala | Glu | Ala | Lys | Val | Glu | Ser | Lys |
| 180 | | | | 185 | | | | 190 | | | | | | | |
| Lys | Ala | Glu | Ala | Thr | Arg | Leu | Glu | Asn | Ile | Lys | Thr | Asp | Arg | Glu | Lys |
| 195 | | | | 200 | | | | 205 | | | | | | | |
| Ala | Glu | Glu | Glu | Ala | Lys | Arg | Arg | Ala | Glu | Ala | Lys | Leu | Lys | Glu | Ala |
| 210 | | | | 215 | | | | 220 | | | | | | | |
| Val | Glu | Lys | Asn | Val | Ala | Thr | Ser | Glu | Gln | Asp | Lys | Pro | Lys | Gly | Arg |
| 225 | | | | 230 | | | | 235 | | | | 240 | | | |
| Arg | Lys | Arg | Gly | Val | Pro | Gly | Glu | Gln | Ala | Thr | Pro | Asp | Lys | Lys | Glu |
| 245 | | | | 250 | | | | 255 | | | | | | | |
| Asn | Asp | Ala | Lys | Ser | Ser | Asp | Ser | Ser | Val | Gly | Glu | Glu | Ala | Leu | Pro |
| 260 | | | | 265 | | | | 270 | | | | | | | |
| Ser | Pro | Ser | Leu | Lys | Pro | Glu | Lys | Lys | Val | Ala | Glu | Ala | Glu | Lys | Lys |
| 275 | | | | 280 | | | | 285 | | | | | | | |
| Val | Ala | Glu | Ala | Glu | Lys | Lys | Ala | Lys | Ala | Gln | Lys | Glu | Glu | Asp | Arg |
| 290 | | | | 295 | | | | 300 | | | | | | | |
| Arg | Asn | Tyr | Pro | Thr | Asn | Thr | Tyr | Lys | Thr | Leu | Glu | Leu | Glu | Ile | Ala |
| 305 | | | | 310 | | | | 315 | | | | 320 | | | |
| Glu | Ser | Asp | Val | Lys | Val | Lys | Glu | Ala | Glu | Leu | Glu | Leu | Val | Lys | Glu |
| 325 | | | | 330 | | | | 335 | | | | | | | |
| Glu | Ala | Lys | Glu | Ser | Arg | Asn | Glu | Glu | Lys | Val | Asn | Gln | Ala | Lys | Ala |
| 340 | | | | 345 | | | | 350 | | | | | | | |
| Lys | Val | Glu | Ser | Lys | Lys | Ala | Glu | Ala | Thr | Arg | Leu | Glu | Lys | Ile | Lys |
| 355 | | | | 360 | | | | 365 | | | | | | | |
| Thr | Asp | Arg | Lys | Lys | Ala | Glu | Glu | Glu | Ala | Lys | Arg | Lys | Ala | Ala | Glu |
| 370 | | | | 375 | | | | 380 | | | | | | | |
| Glu | Asp | Lys | Val | Lys | Glu | Lys | Pro | Ala | Glu | Gln | Pro | Gln | Pro | Ala | Pro |

385 390 395 400
 Ala Pro Gln Pro Glu Lys Pro Thr Glu Glu Pro Glu Asn Pro Ala Pro
 405 410 415
 Ala Pro Lys Pro Glu Lys Pro Ala Glu Gln Pro Lys Ala Glu Lys Thr
 420 425 430
 Asp Asp Gln Gln Ala Glu Glu
 435

 <210> 31
 <211> 419
 <212> PRT
 <213> Streptococcus pneumoniae

 <400> 31
 Ala Val Ala Ser Leu Val Met Gly Ser Val Val His Ala Thr Glu Asn
 1 5 10 15
 Glu Gly Thr Thr Gln Ala Pro Thr Ser Ser Asn Arg Gly Asn Glu Ser
 20 25 30
 Gln Ala Glu His Met Lys Ala Ala Lys Gln Val Asp Glu Tyr Ile Glu
 35 40 45
 Lys Met Leu Gln Leu Asp Arg Arg Lys His Thr Gln Asn Val Gly Leu
 50 55 60
 Leu Thr Lys Leu Gly Ala Ile Lys Thr Glu Tyr Leu Arg Gly Leu Ser
 65 70 75 80
 Val Ser Lys Glu Lys Ser Thr Ala Glu Leu Pro Ser Glu Ile Lys Glu
 85 90 95
 Lys Leu Thr Ala Ala Phe Lys Gln Phe Lys Lys Asp Thr Leu Lys Pro
 100 105 110
 Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Ala Glu Ala Lys Lys
 115 120 125
 Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile
 130 135 140
 Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Glu Val
 145 150 155 160
 Lys Lys Ala Glu Leu Glu Leu Val Lys Val Lys Ala Asn Glu Pro Arg
 165 170 175
 Asp Glu Glu Lys Ile Lys Gln Ala Glu Ala Glu Val Glu Ser Lys Lys
 180 185 190
 Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg Glu Lys Ala
 195 200 205

Glu Glu Glu Ala Lys Arg Arg Val Asp Ala Lys Glu Gln Asp Glu Ser
 210 215 220
 Ser Lys Arg Arg Lys Ser Arg Val Lys Arg Gly Asp Val Gly Glu Gln
 225 230 235 240
 Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala Lys Ser Ser Asp Ser Ser
 245 250 255
 Val Gly Glu Glu Thr Leu Pro Ser Pro Ser Leu Lys Pro Gly Lys Lys
 260 265 270
 Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala Asp Lys Lys Ala Lys
 275 280 285
 Ala Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys
 290 295 300
 Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala
 305 310 315 320
 Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu Pro Arg Asn Glu Glu
 325 330 335
 Lys Val Lys Gln Ala Lys Ala Glu Val Glu Ser Lys Lys Ala Glu Ala
 340 345 350
 Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu
 355 360 365
 Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala
 370 375 380
 Glu Gln Pro Lys Pro Ala Pro Ala Pro Gln Pro Glu Lys Pro Ala Pro
 385 390 395 400
 Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala Glu Lys Pro Ala Asp
 405 410 415
 Gln Gln Ala

<210> 32
 <211> 437
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 32
 Val Ala Ser Leu Phe Met Gly Ser Val Val His Ala Thr Glu Lys Glu
 1 5 10 15
 Val Thr Thr Gln Val Ala Thr Ser Ser Asn Lys Ala Asn Lys Ser Gln
 20 25 30
 Thr Glu His Met Lys Ala Ala Lys Gln Val Asp Glu Tyr Ile Lys Lys
 35 40 45

Lys Leu Gln Leu Asp Arg Arg Lys His Thr Gln Asn Val Gly Leu Leu
 50 55 60
 Thr Lys Leu Gly Val Ile Lys Thr Glu Tyr Leu His Gly Leu Ser Val
 65 70 75 80
 Ser Lys Lys Lys Ser Glu Ala Glu Leu Pro Ser Glu Ile Lys Ala Lys
 85 90 95
 Leu Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu Pro Thr Glu
 100 105 110
 Pro Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala Lys
 115 120 125
 Lys Lys Ala Glu Asp Gln Lys Glu Lys Asp Leu Arg Asn Tyr Pro Thr
 130 135 140
 Asn Thr Tyr Lys Thr Leu Glu Leu Asp Ile Ala Glu Ser Asp Val Glu
 145 150 155 160
 Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu Ser
 165 170 175
 Arg Asp Glu Lys Lys Ile Asn Gln Ala Lys Ala Lys Val Glu Asn Lys
 180 185 190
 Lys Ala Glu Ala Thr Arg Leu Lys Asn Ile Lys Thr Asp Arg Glu Lys
 195 200 205
 Ala Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Leu Gln Glu Ala Asn
 210 215 220
 Val Ala Thr Ser Glu Gln Asp Lys Ser Lys Arg Arg Ala Lys Arg Glu
 225 230 235 240
 Val Phe Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala Lys
 245 250 255
 Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Thr Ser Pro Ser Leu
 260 265 270
 Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala
 275 280 285
 Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro
 290 295 300
 Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val
 305 310 315 320
 Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu
 325 330 335
 Ser Arg Asn Glu Glu Lys Ile Lys Gln Val Lys Ala Lys Val Glu Ser
 340 345 350

Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg Lys
 355 360 365
 Lys Ala Glu Glu Glu Glu Ala Lys Arg Arg Ala Ala Glu Glu Asp Lys
 370 375 380
 Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Gln
 385 390 395 400
 Pro Glu Lys Pro Thr Glu Glu Pro Glu Asn Pro Ala Pro Ala Pro Ala
 405 410 415
 Pro Lys Pro Glu Asn Pro Ala Glu Lys Pro Lys Ala Glu Lys Pro Ala
 420 425 430
 Asp Gln Gln Ala Glu
 435

<210> 33
 <211> 433
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 33
 Cys Thr Val Ala Ser Leu Val Met Gly Ser Val Val His Ala Thr Glu
 1 5 10 15
 Asn Glu Arg Thr Thr Gln Val Pro Thr Ser Ser Asn Arg Gly Lys Pro
 20 25 30
 Glu Arg Arg Lys Ala Ala Glu Gln Phe Asp Glu Tyr Ile Asn Lys Met
 35 40 45
 Ile Gln Leu Asp Lys Arg Lys His Thr Gln Asn Leu Ala Phe Asn Ile
 50 55 60
 Gln Leu Ser Arg Ile Lys Thr Glu Tyr Leu Asn Gly Leu Lys Glu Lys
 65 70 75 80
 Ser Glu Ala Glu Leu Pro Ser Lys Ile Lys Ala Glu Leu Asp Ala Ala
 85 90 95
 Phe Lys Gln Phe Lys Lys Asp Thr Leu Pro Thr Glu Pro Glu Lys Lys
 100 105 110
 Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala Glu Lys Lys Val Ala
 115 120 125
 Glu Ala Lys Lys Lys Ala Lys Ala Gln Lys Glu Glu Asp His Arg Asn
 130 135 140
 Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu Phe
 145 150 155 160
 Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Lys Glu Ala

| 165 | | | | | | | | | | 170 | | | | | 175 | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|--|
| Asp | Glu | Ser | Arg | Asn | Glu | Gly | Thr | Ile | Asn | Gln | Ala | Lys | Ala | Lys | Val | | | | |
| | | | 180 | | | | | 185 | | | | | 190 | | | | | | |
| Glu | Ser | Glu | Lys | Ala | Glu | Ala | Thr | Arg | Leu | Lys | Lys | Ile | Lys | Thr | Asp | | | | |
| | | 195 | | | | | 200 | | | | | 205 | | | | | | | |
| Arg | Glu | Lys | Ala | Glu | Glu | Glu | Glu | Ala | Lys | Arg | Arg | Ala | Asp | Ala | Lys | | | | |
| | 210 | | | | | 215 | | | | | 220 | | | | | | | | |
| Glu | Gln | Asp | Glu | Ser | Lys | Arg | Arg | Lys | Ser | Arg | Gly | Lys | Arg | Gly | Ala | | | | |
| 225 | | | | | 230 | | | | | 235 | | | | | 240 | | | | |
| Leu | Gly | Glu | Gln | Ala | Thr | Pro | Asp | Lys | Lys | Glu | Asn | Asp | Ala | Lys | Ser | | | | |
| | | | | 245 | | | | | 250 | | | | | 255 | | | | | |
| Ser | Asp | Ser | Ser | Val | Gly | Glu | Glu | Thr | Leu | Pro | Ser | Pro | Ser | Leu | Lys | | | | |
| | | | 260 | | | | | 265 | | | | | | 270 | | | | | |
| Pro | Gly | Lys | Lys | Val | Ala | Glu | Ala | Glu | Lys | Lys | Val | Glu | Glu | Ala | Asp | | | | |
| | | 275 | | | | | 280 | | | | | 285 | | | | | | | |
| Lys | Lys | Ala | Lys | Ala | Gln | Lys | Glu | Glu | Asp | Arg | Arg | Asn | Tyr | Pro | Thr | | | | |
| | 290 | | | | | 295 | | | | | 300 | | | | | | | | |
| Asn | Thr | Tyr | Lys | Thr | Leu | Glu | Leu | Glu | Ile | Ala | Glu | Ser | Asp | Val | Lys | | | | |
| 305 | | | | | 310 | | | | | 315 | | | | | 320 | | | | |
| Val | Lys | Glu | Ala | Glu | Leu | Glu | Leu | Val | Lys | Glu | Glu | Ala | Lys | Glu | Ser | | | | |
| | | | | 325 | | | | | 330 | | | | | 335 | | | | | |
| Arg | Asn | Glu | Glu | Lys | Ile | Lys | Gln | Ala | Lys | Ala | Lys | Val | Glu | Ser | Lys | | | | |
| | | | 340 | | | | | 345 | | | | | 350 | | | | | | |
| Lys | Ala | Glu | Ala | Thr | Arg | Leu | Glu | Lys | Ile | Lys | Thr | Asp | Arg | Lys | Lys | | | | |
| | | 355 | | | | | 360 | | | | | 365 | | | | | | | |
| Ala | Glu | Glu | Glu | Ala | Lys | Arg | Lys | Ala | Ala | Glu | Glu | Asp | Lys | Val | Lys | | | | |
| | 370 | | | | | 375 | | | | | 380 | | | | | | | | |
| Glu | Lys | Pro | Ala | Glu | Gln | Pro | Gln | Pro | Ala | Pro | Ala | Pro | Gln | Pro | Glu | | | | |
| 385 | | | | | 390 | | | | | 395 | | | | | 400 | | | | |
| Lys | Pro | Ala | Glu | Glu | Pro | Glu | Asn | Pro | Val | Pro | Ala | Pro | Lys | Pro | Glu | | | | |
| | | | | 405 | | | | | 410 | | | | | 415 | | | | | |
| Asn | Pro | Ala | Glu | Gln | Pro | Lys | Ala | Glu | Lys | Pro | Ala | Asp | Gln | Gln | Ala | | | | |
| | | | 420 | | | | | 425 | | | | | 430 | | | | | | |

Glu

<210> 34
 <211> 427
 <212> PRT

<213> Streptococcus pneumoniae

<400> 34

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Val | Ala | Val | Ala | Ser | Leu | Val | Met | Gly | Ser | Val | Val | His | Ala | Thr | Glu | |
| 1 | | | | 5 | | | | | 10 | | | | | 15 | | |
| Lys | Glu | Val | Thr | Thr | Gln | Val | Pro | Thr | Tyr | Ser | Asn | Met | Ala | Lys | Thr | |
| | | | 20 | | | | | 25 | | | | | 30 | | | |
| Glu | His | Arg | Lys | Ala | Ala | Lys | Gln | Val | Val | Asp | Glu | Tyr | Ile | Glu | Lys | |
| | | 35 | | | | | 40 | | | | | 45 | | | | |
| Met | Leu | Arg | Glu | Ile | Gln | Leu | Asp | Arg | Arg | Lys | His | Thr | Gln | Asn | Phe | |
| | 50 | | | | | 55 | | | | | 60 | | | | | |
| Ala | Phe | Asn | Met | Lys | Leu | Ser | Ala | Ile | Lys | Thr | Glu | Tyr | Leu | Tyr | Gly | |
| 65 | | | | | 70 | | | | | 75 | | | | | 80 | |
| Leu | Lys | Glu | Lys | Ser | Glu | Ala | Glu | Leu | Pro | Ser | Glu | Val | Lys | Ala | Lys | |
| | | | | 85 | | | | | 90 | | | | | 95 | | |
| Leu | Asp | Ala | Ala | Phe | Glu | Gln | Phe | Lys | Lys | Asp | Thr | Leu | Lys | Leu | Gly | |
| | | | 100 | | | | | 105 | | | | | 110 | | | |
| Glu | Lys | Val | Ala | Glu | Ala | Glu | Lys | Lys | Val | Ala | Glu | Ala | Glu | Lys | Lys | |
| | | 115 | | | | | 120 | | | | | 125 | | | | |
| Ala | Lys | Ala | Gln | Lys | Glu | Glu | Asp | Arg | Arg | Asn | Tyr | Pro | Thr | Asn | Thr | |
| | 130 | | | | | 135 | | | | | 140 | | | | | |
| Tyr | Lys | Thr | Leu | Glu | Leu | Glu | Ile | Ala | Glu | Ser | Asp | Val | Glu | Val | Lys | |
| 145 | | | | 150 | | | | | | 155 | | | | | 160 | |
| Lys | Ala | Glu | Leu | Glu | Leu | Leu | Lys | Glu | Glu | Ala | Lys | Thr | Arg | Asn | Glu | |
| | | | 165 | | | | | 170 | | | | | | 175 | | |
| Asp | Thr | Ile | Asn | Gln | Ala | Lys | Ala | Lys | Val | Glu | Ser | Lys | Lys | Ala | Glu | |
| | | 180 | | | | | 185 | | | | | | 190 | | | |
| Ala | Thr | Lys | Leu | Glu | Glu | Ile | Lys | Thr | Asp | Arg | Lys | Lys | Ala | Glu | Glu | |
| | | 195 | | | | | 200 | | | | | 205 | | | | |
| Glu | Ala | Lys | Arg | Lys | Ala | Glu | Ala | Glu | Glu | Asp | Lys | Val | Lys | Asp | Lys | |
| | 210 | | | | | 215 | | | | | 220 | | | | | |
| Leu | Lys | Arg | Arg | Thr | Lys | Arg | Ala | Val | Pro | Gly | Glu | Pro | Ala | Thr | Pro | |
| 225 | | | | 230 | | | | | | 235 | | | | | 240 | |
| Asp | Lys | Lys | Glu | Asn | Asp | Ala | Lys | Ser | Ser | Asp | Ser | Ser | Val | Gly | Glu | |
| | | | 245 | | | | | 250 | | | | | | 255 | | |
| Glu | Thr | Leu | Pro | Ser | Pro | Ser | Leu | Lys | Ser | Gly | Lys | Lys | Val | Ala | Glu | |
| | | 260 | | | | | 265 | | | | | | 270 | | | |
| Ala | Glu | Lys | Lys | Val | Ala | Glu | Ala | Glu | Lys | Lys | Ala | Lys | Asp | Gln | Lys | |
| | 275 | | | | | 280 | | | | | | 285 | | | | |

Glu Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp
 290 295 300
 Leu Glu Ile Ala Glu Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu
 305 310 315 320
 Leu Val Lys Glu Glu Ala Lys Gly Ser Arg Asn Glu Glu Lys Ile Asn
 325 330 335
 Gln Ala Lys Ala Glu Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu
 340 345 350
 Glu Lys Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg
 355 360 365
 Lys Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro
 370 375 380
 Gln Pro Ala Pro Ala Pro Gln Pro Glu Lys Pro Thr Glu Glu Pro Glu
 385 390 395 400
 Asn Pro Ala Pro Ala Pro Lys Pro Glu Lys Pro Ala Glu Gln Pro Lys
 405 410 415
 Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu Glu
 420 425

<210> 35
 <211> 413
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 35
 Glu Asn Glu Gly Ser Thr Gln Ala Ala Thr Ser Ser Asn Met Ala Lys
 1 5 10 15
 Thr Glu His Arg Lys Ala Ala Lys Gln Val Val Asp Glu Tyr Ile Glu
 20 25 30
 Lys Met Leu Arg Glu Ile Gln Leu Asp Arg Arg Lys His Thr Gln Asn
 35 40 45
 Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg
 50 55 60
 Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu
 65 70 75 80
 Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr
 85 90 95
 Leu Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu
 100 105 110
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 115 120 125

Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp
 130 135 140
 Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys
 145 150 155 160
 Glu Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu
 165 170 175
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg
 180 185 190
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys
 195 200 205
 Glu Ala Asn Val Ala Thr Ser Asp Gln Gly Lys Pro Lys Gly Arg Ala
 210 215 220
 Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn
 225 230 235 240
 Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser
 245 250 255
 Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val
 260 265 270
 Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg
 275 280 285
 Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu
 290 295 300
 Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu
 305 310 315 320
 Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys
 325 330 335
 Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr
 340 345 350
 Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu
 355 360 365
 Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala
 370 375 380
 Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys Pro Ala Glu Gln
 385 390 395 400
 Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu Glu
 405 410

<210> 36

<211> 425
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 36

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Tyr | Ile | Ala | Ser | Leu | Phe | Leu | Gly | Gly | Val | Val | His | Ala | Glu | Gly | Val |
| 1 | | | | 5 | | | | | 10 | | | | | 15 | |
| Arg | Ser | Glu | Asn | Asn | Pro | Thr | Val | Thr | Ser | Ser | Gly | Gln | Asp | Ile | Ser |
| | | | 20 | | | | | 25 | | | | | 30 | | |
| Lys | Lys | Tyr | Ala | Asp | Glu | Val | Lys | Ser | His | Leu | Glu | Lys | Ile | Leu | Ser |
| | | 35 | | | | | 40 | | | | | 45 | | | |
| Glu | Ile | Gln | Thr | Asn | Leu | Asp | Arg | Ser | Lys | His | Ile | Lys | Thr | Val | Asn |
| | 50 | | | | | 55 | | | | | 60 | | | | |
| Leu | Ile | Asn | Lys | Leu | Gln | Asp | Ile | Lys | Arg | Thr | Tyr | Leu | Tyr | Glu | Leu |
| 65 | | | | | 70 | | | | 75 | | | | | | 80 |
| Asn | Val | Leu | Glu | Asp | Lys | Ser | Lys | Ala | Glu | Leu | Pro | Ser | Lys | Ile | Lys |
| | | | | 85 | | | | | 90 | | | | | 95 | |
| Ala | Glu | Leu | Asp | Ala | Ala | Phe | Glu | Gln | Phe | Lys | Lys | Asp | Thr | Leu | Pro |
| | | | 100 | | | | | 105 | | | | | 110 | | |
| Thr | Glu | Pro | Gly | Lys | Lys | Val | Ala | Glu | Ala | Lys | Lys | Lys | Val | Glu | Glu |
| | | 115 | | | | | 120 | | | | | | 125 | | |
| Ala | Glu | Lys | Lys | Ala | Lys | Ala | Gln | Lys | Glu | Glu | Asp | Tyr | Arg | Asn | Tyr |
| | 130 | | | | | 135 | | | | | 140 | | | | |
| Pro | Thr | Ile | Thr | Tyr | Lys | Thr | Leu | Glu | Leu | Glu | Ile | Ala | Glu | Ser | Asp |
| 145 | | | | | 150 | | | | | 155 | | | | | 160 |
| Val | Lys | Val | Lys | Glu | Ala | Glu | Leu | Glu | Leu | Val | Lys | Lys | Glu | Ala | Asp |
| | | | | 165 | | | | | 170 | | | | | 175 | |
| Glu | Ser | Arg | Asn | Glu | Gly | Thr | Ile | Asn | Gln | Ala | Lys | Ala | Lys | Val | Glu |
| | | | 180 | | | | | 185 | | | | | 190 | | |
| Ser | Glu | Gln | Ala | Glu | Ala | Thr | Arg | Leu | Lys | Lys | Ile | Lys | Thr | Asp | Arg |
| | | 195 | | | | | 200 | | | | | 205 | | | |
| Glu | Lys | Ala | Glu | Glu | Glu | Ala | Lys | Arg | Arg | Ala | Asp | Ala | Lys | Glu | Gln |
| | 210 | | | | | 215 | | | | | 220 | | | | |
| Asp | Glu | Ser | Lys | Arg | Arg | Lys | Ser | Arg | Val | Lys | Arg | Gly | Asp | Phe | Gly |
| 225 | | | | | 230 | | | | | 235 | | | | | 240 |
| Glu | Pro | Ala | Thr | Pro | Asp | Lys | Lys | Glu | Asn | Asp | Ala | Lys | Ser | Ser | Asp |
| | | | | 245 | | | | | 250 | | | | | 255 | |
| Ser | Ser | Val | Gly | Glu | Glu | Thr | Leu | Pro | Ser | Pro | Ser | Leu | Lys | Pro | Gly |
| | | | 260 | | | | | 265 | | | | | 270 | | |
| Lys | Lys | Val | Ala | Glu | Ala | Glu | Lys | Lys | Val | Glu | Glu | Ala | Glu | Lys | Lys |

| 275 | 280 | 285 |
|--|-----|---------|
| Ala Lys Asp Gln Lys Glu Glu Asp His Arg Asn Tyr Pro Thr Ile Thr 290 | 295 | 300 |
| Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys 305 | 310 | 315 320 |
| Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Gly Ser Arg Asn 325 | 330 | 335 |
| Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu Ser Lys Lys Ala 340 | 345 | 350 |
| Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys Lys Ala Glu 355 | 360 | 365 |
| Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys Val Lys Glu Lys 370 | 375 | 380 |
| Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Gln Pro Glu Lys Pro 385 | 390 | 395 400 |
| Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala Glu 405 | 410 | 415 |
| Lys Pro Ala Asp Gln Gln Ala Glu Glu 420 | 425 | |

<210> 37
 <211> 439
 <212> PRT
 <213> Streptococcus pneumoniae

| |
|--|
| <400> 37 |
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| Gly Asn Asn Ser Thr Val Thr Ser Ser Gly Gln Asp Ile Ser Lys Lys 20 25 30 |
| Tyr Ala Asp Glu Val Glu Ser His Leu Gln Ser Ile Leu Lys Asp Val 35 40 45 |
| Asn Lys Asn Leu Lys Lys Val Gln His Thr Gln Asn Ala Asp Phe Asn 50 55 60 |
| Lys Lys Leu Ser Lys Ile Lys Thr Lys Tyr Leu Tyr Glu Leu Asn Val 65 70 75 80 |
| Leu Glu Glu Lys Ser Glu Ala Glu Leu Thr Ser Lys Thr Lys Glu Thr 85 90 95 |
| Lys Glu Glu Leu Thr Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu 100 105 110 |

Ser Thr Glu Pro Glu Lys Lys Val Ala Glu Ala Lys Lys Lys Val Glu
 115 120 125
 Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Lys Asp Arg Arg Asn
 130 135 140
 Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser
 145 150 155 160
 Asp Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Val Lys Ala
 165 170 175
 Asn Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Glu Ala Lys Val
 180 185 190
 Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp
 195 200 205
 Arg Glu Gln Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg
 210 215 220
 Glu Gln Ala Glu Glu Glu Ala Lys Val Lys Asp Glu Pro Lys Lys Arg
 225 230 235 240
 Thr Lys Arg Gly Val Leu Gly Glu Pro Ala Thr Pro Asp Lys Lys Glu
 245 250 255
 Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro
 260 265 270
 Ser Pro Ser Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys
 275 280 285
 Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg
 290 295 300
 Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala
 305 310 315 320
 Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu
 325 330 335
 Glu Ala Lys Glu Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala
 340 345 350
 Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys
 355 360 365
 Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu
 370 375 380
 Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro
 385 390 395 400
 Ala Pro Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys Pro Ala Pro
 405 410 415

Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala Glu Lys Pro
420 425 430

Ala Asp Gln Gln Ala Glu Glu
435

<210> 38

<211> 460

<212> PRT

<213> Streptococcus pneumoniae

<400> 38

Cys Ile Val Ala Ser Leu Val Met Gly Ser Val Val His Ala Thr Glu
1 5 10 15

Asn Glu Gly Ala Thr Gln Val Pro Thr Ser Ser Asn Arg Ala Asn Glu
20 25 30

Ser Gln Ala Glu Gln Gly Glu Gln Pro Lys Lys Leu Asp Ser Glu Arg
35 40 45

Asp Lys Ala Arg Lys Glu Val Glu Glu Tyr Val Lys Lys Ile Val Gly
50 55 60

Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val Ala
65 70 75 80

Leu Val Asn Glu Leu Asn Asn Ile Lys Asn Glu Tyr Leu Asn Lys Ile
85 90 95

Val Glu Ser Thr Ser Glu Ser Gln Leu Gln Ile Leu Met Met Glu Ser
100 105 110

Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser Ser
115 120 125

Ser Ser Ser Ser Ser Asp Ser Ser Thr Lys Pro Glu Ala Ser Asp Thr
130 135 140

Ala Lys Pro Asn Lys Pro Thr Glu Pro Gly Glu Lys Val Ala Glu Ala
145 150 155 160

Lys Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu
165 170 175

Glu Asp Arg Arg Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu Leu
180 185 190

Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu Leu
195 200 205

Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys Gln
210 215 220

Ala Glu Ala Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu Lys
225 230 235 240

Lys Ile Lys Thr Asp Arg Glu Glu Ala Glu Glu Glu Ala Lys Arg Arg
 245 250 255
 Ala Asp Ala Lys Glu Gln Gly Lys Pro Lys Gly Arg Ala Lys Arg Gly
 260 265 270
 Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala Lys
 275 280 285
 Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser Leu
 290 295 300
 Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala
 305 310 315 320
 Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro
 325 330 335
 Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val
 340 345 350
 Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu
 355 360 365
 Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu Ser
 370 375 380
 Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys
 385 390 395 400
 Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys Val
 405 410 415
 Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Lys Ala
 420 425 430
 Glu Lys Pro Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln Pro
 435 440 445
 Lys Ala Glu Lys Pro Ala Asp Gln Gln Ala Glu Glu
 450 455 460

<210> 39
 <211> 459
 <212> PRT
 <213> Streptococcus pneumoniae

<400> 39
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 1 5 10 15
 Glu Gly Ala Thr Gln Val Pro Thr Ser Ser Asn Arg Ala Asn Glu Ser
 20 25 30
 Gln Ala Glu Gln Gly Glu Gln Pro Lys Lys Leu Asp Ser Glu Arg Asp

| 35 | | | | | 40 | | | | | 45 | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Lys | Ala | Arg | Lys | Glu | Val | Glu | Glu | Tyr | Val | Lys | Lys | Ile | Val | Gly | Glu |
| 50 | | | | | | 55 | | | | | 60 | | | | |
| Ser | Tyr | Ala | Lys | Ser | Thr | Lys | Lys | Arg | His | Thr | Ile | Thr | Val | Ala | Leu |
| 65 | | | | | 70 | | | | | 75 | | | | | 80 |
| Val | Asn | Glu | Leu | Asn | Asn | Ile | Lys | Asn | Glu | Tyr | Leu | Asn | Lys | Ile | Val |
| | | | | 85 | | | | | 90 | | | | | 95 | |
| Glu | Ser | Thr | Ser | Glu | Ser | Gln | Leu | Gln | Ile | Leu | Met | Met | Glu | Ser | Arg |
| | | | 100 | | | | | 105 | | | | | 110 | | |
| Ser | Lys | Val | Asp | Glu | Ala | Val | Ser | Lys | Phe | Glu | Lys | Asp | Ser | Ser | Ser |
| | | 115 | | | | | 120 | | | | | 125 | | | |
| Ser | Ser | Ser | Ser | Asp | Ser | Ser | Thr | Lys | Pro | Glu | Ala | Ser | Asp | Thr | Ala |
| | | 130 | | | | | 135 | | | | | 140 | | | |
| Lys | Pro | Asn | Lys | Pro | Thr | Glu | Pro | Gly | Glu | Lys | Val | Ala | Glu | Ala | Lys |
| 145 | | | | | | 150 | | | | | 155 | | | | 160 |
| Lys | Lys | Val | Glu | Glu | Val | Glu | Lys | Lys | Ala | Lys | Asp | Gln | Lys | Glu | Glu |
| | | | | 165 | | | | | 170 | | | | | 175 | |
| Asp | Arg | Arg | Asn | Tyr | Pro | Thr | Ile | Thr | Tyr | Lys | Thr | Leu | Glu | Leu | Glu |
| | | | 180 | | | | | 185 | | | | | 190 | | |
| Ile | Ala | Glu | Ser | Asp | Val | Glu | Val | Lys | Lys | Ala | Glu | Leu | Glu | Leu | Val |
| | | 195 | | | | | 200 | | | | | 205 | | | |
| Lys | Val | Lys | Ala | Asn | Glu | Pro | Arg | Asp | Lys | Gln | Lys | Ile | Lys | Gln | Ala |
| | 210 | | | | | 215 | | | | | 220 | | | | |
| Glu | Ala | Glu | Val | Glu | Ser | Lys | Gln | Ala | Glu | Ala | Thr | Arg | Leu | Lys | Lys |
| 225 | | | | | | 230 | | | | | 235 | | | | 240 |
| Ile | Lys | Thr | Asp | Arg | Glu | Glu | Ala | Glu | Glu | Glu | Ala | Lys | Arg | Arg | Ala |
| | | | 245 | | | | | | 250 | | | | | 255 | |
| Asp | Ala | Lys | Glu | Gln | Gly | Lys | Pro | Lys | Gly | Arg | Pro | Lys | Arg | Gly | Val |
| | | | 260 | | | | | 265 | | | | | 270 | | |
| Pro | Gly | Glu | Leu | Ala | Thr | Pro | Asp | Lys | Lys | Glu | Asn | Asp | Ala | Lys | Ser |
| | | 275 | | | | | 280 | | | | | 285 | | | |
| Ser | Asp | Ser | Ser | Val | Gly | Glu | Glu | Thr | Leu | Pro | Ser | Pro | Ser | Leu | Lys |
| | 290 | | | | | 295 | | | | | 300 | | | | |
| Pro | Glu | Lys | Lys | Val | Ala | Glu | Ala | Glu | Lys | Lys | Val | Glu | Glu | Ala | Lys |
| 305 | | | | | | 310 | | | | | 315 | | | | 320 |
| Lys | Lys | Ala | Glu | Asp | Gln | Lys | Glu | Glu | Asp | Arg | Arg | Asn | Tyr | Pro | Thr |
| | | | 325 | | | | | | 330 | | | | | 335 | |
| Asn | Thr | Tyr | Lys | Thr | Leu | Glu | Leu | Glu | Ile | Ala | Glu | Ser | Asp | Val | Glu |

| | | |
|---|-----|-----|
| 340 | 345 | 350 |
| Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu Pro | | |
| 355 | 360 | 365 |
| Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu Ser Lys | | |
| 370 | 375 | 380 |
| Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys Lys | | |
| 385 | 390 | 395 |
| Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys Val Lys | | |
| 405 | 410 | 415 |
| Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Lys Thr Glu | | |
| 420 | 425 | 430 |
| Lys Pro Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys | | |
| 435 | 440 | 445 |
| Ala Glu Lys Pro Ala Asp Gln Gln Ala Glu Glu | | |
| 450 | 455 | |

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 <211> 437
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> consensus sequence

| |
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| <400> 40 |
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| Glu Val Thr Thr Gln Val Ala Thr Ser Ser Asn Arg Ala Asn Glu Ser |
| 20 25 30 |
| Gln Thr Glu His Arg Lys Ala Ala Lys Gln Val Asp Glu Tyr Ile Lys |
| 35 40 45 |
| Lys Met Leu Gln Leu Asp Arg Arg Lys His Thr Gln Asn Val Ala Leu |
| 50 55 60 |
| Asn Thr Lys Leu Ser Ala Ile Lys Thr Glu Tyr Leu Asn Gly Leu Ser |
| 65 70 75 80 |
| Val Leu Glu Glu Lys Ser Glu Ala Glu Leu Pro Ser Glu Ile Lys Ala |
| 85 90 95 |
| Lys Leu Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu Pro Thr |
| 100 105 110 |
| Glu Pro Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala |
| 115 120 125 |

Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro
 130 135 140
 Thr Ile Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val
 145 150 155 160
 Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu
 165 170 175
 Ser Arg Asp Glu Gly Lys Ile Asn Gln Ala Lys Ala Lys Val Glu Ser
 180 185 190
 Lys Lys Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg Glu
 195 200 205
 Lys Ala Glu Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Leu Gln Glu
 210 215 220
 Ala Asn Val Ala Ser Glu Gln Asp Lys Pro Lys Gly Arg Ala Lys Arg
 225 230 235 240
 Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala
 245 250 255
 Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser
 260 265 270
 Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu
 275 280 285
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr
 290 295 300
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp
 305 310 315 320
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys
 325 330 335
 Glu Ser Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu
 340 345 350
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg
 355 360 365
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys
 370 375 380
 Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Gln
 385 390 395 400
 Pro Glu Lys Pro Ala Glu Glu Pro Glu Asn Pro Ala Pro Ala Pro Pro
 405 410 415
 Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala Glu Lys Pro Ala Asp
 420 425 430

Gln Gln Ala Glu Glu
435

<210> 41
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide primer

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<222> 15
<223> r = A or G

<221> misc_feature
<222> 18
<223> y = C or T

<221> misc_feature
<222> 21
<223> r = A or G

<400> 41
ggc gga tcc atg gar aay gar gg 23

<210> 42
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide primer

<400> 42
gcc gtc gac tta gtt tac cca ttc acc att ggc 33